CLAIMS

What is claimed is:

1.   A method for filtering two or more signals received over two or more primary channels in a multichannel communication system comprising:

receiving two or more signals over two or more primary channels, the two or more primary channels adjacent at least one alien channel;

pre-processing the two or more signals to create two or more pre-processed signals;

providing the two or more pre-processed signals to a matrix filter, the matrix filter configured with a transfer function that is the inverse of the two or more channels to thereby cancel at least a portion of unwanted coupling onto the two or more primary channels from the primary channels and that will reverse the effects of the channel on the two or more signals;

processing the two or more signals within the matrix filter to generate two or more output signals;

processing the two or more outputs to isolate a noise term associated with at least one channel;

filtering the noise term to generate at least one noise cancellation signal; and

combining the noise cancellation signal with at least one of the two or more output signals, wherein combining the noise cancellation signal with at least one of the two or more output signals cancels unwanted noise on the at least one of the two or more output signals.

2.   The method of Claim 1, wherein the processing comprises discrete multi-tone type processing.

3.   The method of Claim 1, wherein the matrix filter comprises a feedforward matrix filter configured to cancel self FEXT and distortion caused by transmission through a channel.

4.   The method of Claim 1, where processing the two or more signals within the matrix filter is performed at the transmitter prior to transmission of the two or more signals onto the two or more primary channels instead of at a receiver.

5.   The method of Claim 1, wherein the noise term comprises the difference between an output signal from the matrix filter for a particular channel and an output from a slicer for a particular channel.

6.   The method of Claim 1, wherein the matrix filter comprises a digital signal processor executing software code.

7.   The method of Claim 1, wherein the coupling does not comprise self FEXT and the matrix filter is configured as a diagonalized matrix filter.

8.   The method of Claim 1, wherein the two or more channels comprises fourteen channels and wherein filtering the noise term comprises providing the noise term to a filter that is tailored to generate a cancellation signal capable of canceling noise on one or more subsequent channels.

9.   The method of Claim 1, wherein the two or more channels comprise six to fourteen channels configured to transmit data over six to fourteen twisted pair conductors.

10. A system for processing two or more signals associated with a multi-channel communication path, wherein a signal is associated with each channel of the multi-channel communication path, to cancel coupling onto the two or more signals from other of the signals associated with a multi-channel communication system or signals associated with other communication systems, the system comprising:

a first filter system and a second filter system, the first filter system comprising:

two or more inputs configured to receive the two or more signals;

at least one multiplier associated with each channel of the multi-channel communication path, the at least one multiplier configured to perform at least one multiplication between the signal associated with the channel and at least one filter value multiplier to create a first filter system output associated with each channel;

two or more outputs configured to provide the first filter system output to the second filter system; and

the second filter system comprising:

a decision device associated with each channel, the decision device configured to generate a decision signal;

a first junction associated with each channel, the first junction configured to combine the decision signal with the first filter system output or a signal based on the first filter system output, the combination thereby generating a noise signal;

at least one filter configured to process the noise signal to generate a cancellation signal;

at least one second junction configured to combine the cancellation signal with a first filter system output to thereby cancel noise from at least one first filter system output.

11. The system of Claim 10, wherein the coupling comprises alien FEXT and alien NEXT.

12.   The system of Claim 10, wherein the decision device comprises a slicer.

13.   The system of Claim 10, wherein the decision signal represents a decision regarding an aspect of transmitted signal value.

14.   The system of Claim 10, wherein the junction represents a subtractor.

15.   The system of Claim 10, wherein the first filter system comprises a M by M matrix filter and the variable M represents the number of channels.

16.   The system of Claim 10, wherein the channels comprise a first through Mth channel and the first filter system output comprises a first filter system output associated with each channel and wherein the second filter system operates on a first channel signal to generate a first channel noise cancellation signal that is provided to at least the second channel to cancel noise on the second channel.

17.   The system of Claim 16, wherein the second channel signal, after combination with the first channel noise cancellation signal, is provided to a decision device associated with the second channel.

18.   The system of Claim 17, wherein a cancellation signal is provided to a third channel that accounts for the noise filtered from the signal on the first channel and the signal on the second channel.

19.   The system of Claim 10, wherein the first filter system is located in a transmitter to pre-process the two or more signals prior to transmission over the multi-channel communication path.

20.   A method for processing two or more received primary signals to cancel unwanted coupling onto the two more primary signals from alien signals, the method comprising:

receiving two or more signals, wherein each of the two or more signals comprise primary components and coupling components;

for a first signal of the two or more signals, performing a decision operation to isolate the primary component;

subtracting the primary component from the first signal to isolate the coupling component;

filtering the coupling component to generate a cancellation signal; and

combining the cancellation signal with second signal of the two or more signals to remove at least a portion of the coupling component from the second signal.

21.   The method of Claim 20, wherein the two or more signals comprise twelve signals received over twelve twisted pair conductors.

22.   The method of Claim 20, wherein filtering comprises multiplying the coupling component by a complex number to generate a cancellation signal.

23.   The method of Claim 20, wherein the coupling component may comprise alien NEXT, alien FEXT, or both.

24.   The method of Claim 20, further comprising:

performing a decision operation on the second signal to isolate the primary component of the second signal;

subtracting the primary component of the second signal from the second signal to isolate the coupling component of the second signal;

filtering the coupling component of the second signal to generate a second cancellation signal; and

combining the cancellation signal from the first channel and the second cancellation signal with a third signal to remove at least a portion of the coupling component from the third signal.

25.   The method of Claim 20, further comprising processing the two or more signals with a diagonalized matrix filter to reverse the effects of the channel.

26.   The method of Claim 20, further comprising processing the two or more signals with a matrix filter to reverse the effects of the channel and cancel self FEXT coupling.

27.   The method of Claim 26, wherein the matrix filter performs matrix multiplication with one or more complex values on the two or more signals.

28.   The method of Claim 26, further comprising pre-processing the two or more received primary signals prior to the two or more received primary signals being received, wherein pre-processing comprises processing with a matrix filter to account for the effects of the channel, self FEXT, or both.

29.   A method for filtering two or more signals received over two or more primary channels in a multichannel communication system comprising:

        receiving two or more signals over two or more primary channels, the two or more primary channels adjacent at least one alien channel;

        pre-processing the two or more signals to create two or more pre-processed signals;

        providing the two or more pre-processed signals to a matrix filter, the matrix filter configured with a transfer function that is the inverse of the two or more channels to thereby reverse the effects of the channel on the two or more signals; and

        processing the two or more signals within the matrix filter to generate two or more output signals.

30.   The method of Claim 29, wherein transfer function is controlled by one or more matrix values that represent filter coefficients.

31.   The method of Claim 29, wherein the matrix filter is further configured to cancel at least a portion of unwanted coupling onto the two or more primary channels from the primary channels.

32.   The method of Claim 29, where processing the two or more signals within the matrix filter is performed at the transmitter prior to transmission of the two or more signals onto the two or more primary channels.

33.   The method of Claim 29, wherein the matrix filter comprises a digital signal processor executing software code.

34.   The method of Claim 29, wherein the coupling does not comprise alien NEXT.

35.   The method of Claim 29, wherein the matrix filter is the only filter configured to reverse the effect of the channel on the two or more signals.

36.   The method of Claim 29, wherein the two or more channels comprise six to fourteen channels configured to transmit data over six to fourteen twisted pair conductors.